

Tri-National Workshop on Standards for Nanotechnology

ISO TC201/SC9:
Scanned Probe Microscopy –

And SG3:
*Guidelines for Image/Artifact
Interpretation*

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Outline

- Introduction
- ISO/TC201/SC9:
 - Scope & Timeline
 - SGs, WGs, and current work items
- Preview of SG3 Chair's Perceived Needs from Tri-National Cooperation Perspective
- ISO/TC201/SC9/SG3 Amplification:
 - Year 1: Dialogue with membership
 - Year 2: Survey and Results
 - Year 3: Poll and Results
 - Year 4: In Progress
- Summary and Discussion

Sub-Committees of ISO/TC201

ISO/TC201 – Surface Chemical Analysis

Current TC201 Sub-committees:

- *SC1 – Terms and Definitions*
- *SC2 – General Procedures*
- *SC3 – Data Management**
- *SC4 – Depth Profiling*
- *SC5 – Auger electron spectroscopy*
- *SC6 – SIMS*
- *SC7 – XPS*
- *SC8 – Glow Discharge Spectroscopy*
- *SC9 – Scanned Probe Microscopy*

*Technology cross-cutting sub committee

NIST Staff Participation in TC201

Cedric Powell, CSTL Emeritus

- De facto Dean of NIST Delegation to TC201*
- Multi-SC expert*

Michael Winchester, CSTL, ACD (839)

- Delegate and SC8 expert*

David Simons, CSTL, SMSD (837)

- Delegate and multi-SC expert*

Ronald Dixon, MEL, PED (821)

- Delegate, SC9 member, and chair of SG3*

Timeline of SC9 Activities

- **October 2003 – Sub-committee SC9 on scanned probe microscopy chartered by TC201**
- **October 2004 – First meeting of SC9**
 - **Five Study Groups chartered**
 - **U.S. designated to lead SG3**
 - *R. Dixon nominated SG3 chair*
- **Sept. 2005 – Chairs of SGs present first year findings at meeting of TC/201/SC9**
- **Nov. 2006 – Chairs of SGs present second year findings at TC/201/SC9 meeting**
 - *WG1 launched from SG4*
- **Nov. 2007 – Chairs of SGs present third year findings at meeting of TC/201/SC9**

Scope of SC9: SCs and Work Items

TC201/SC9 sub structure:

Initial Study Groups:

- *SG1 – Business Plan*
- *SG2 – SPM Calibration*
- *SG3 – Artifacts in AFM Imaging*
- *SG4 – NSOM*
- *SG5 – SPM Probe/Tip effects*

Working Groups and Work Items:

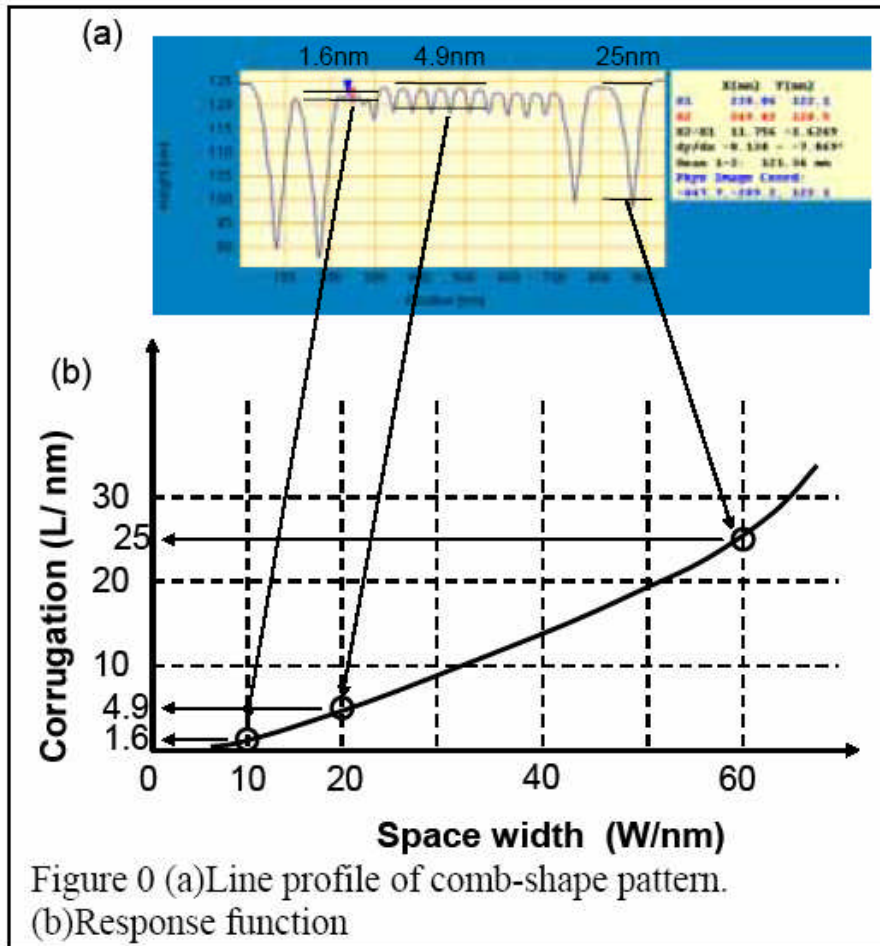
- *WG1 – NSOM*
 - AWI: Definition/calibration of spatial resolution
 - KATS, J. Kim
- *SC3/WG1 – Data Transfer*
 - NWIP: Standard Format for SPM Data Sharing*

Scope of SC9: New Work Item Proposals

TC201/SC9 Current New Work Item Proposals (NWIP):

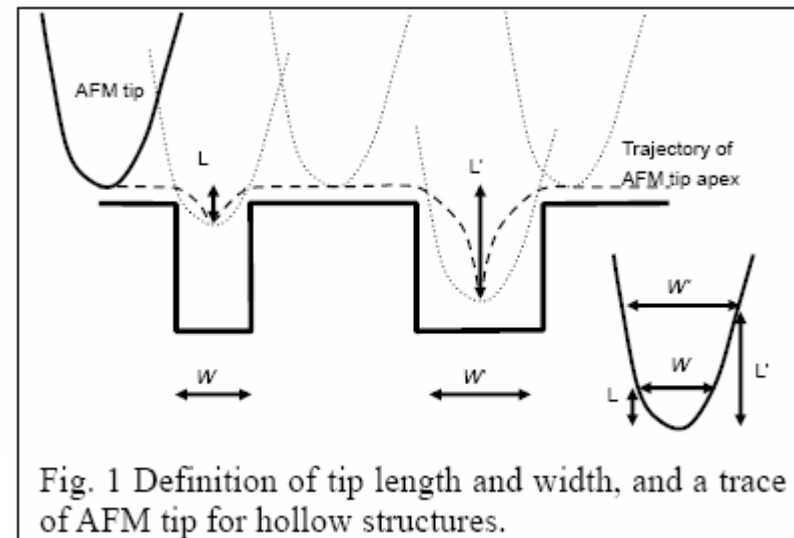
- *SG2 – SPM calibration*
 - *SPM drift rate definition and appropriate calibration methods for its determination (Prof. Huang)*
 - *SPM calibration guideline (Dr. Dziomba)*
 - *Reference Materials and Calibration Methods for SPM (Dr. Itoh)*
 - *Standards on the measurement of angle between an AFM tip and surface and its certified reference material (Dr. Seongmin Cho)*
- *SG5 – SPM Probe/Tip effects*
 - ➡ • ***Procedure for in situ characterization for AFM probes used for nanostructure measurement (Dr. Ichimura) SG5***
 - *Atomic force Microscopy- Determination of cantilever normal spring constant (Dr. Clifford) SG5*

NWIP: Tip Characterization



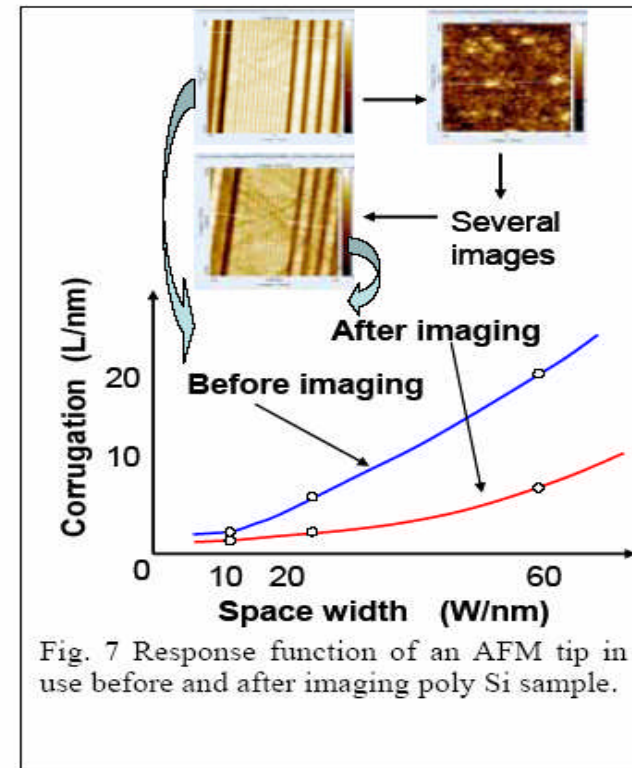
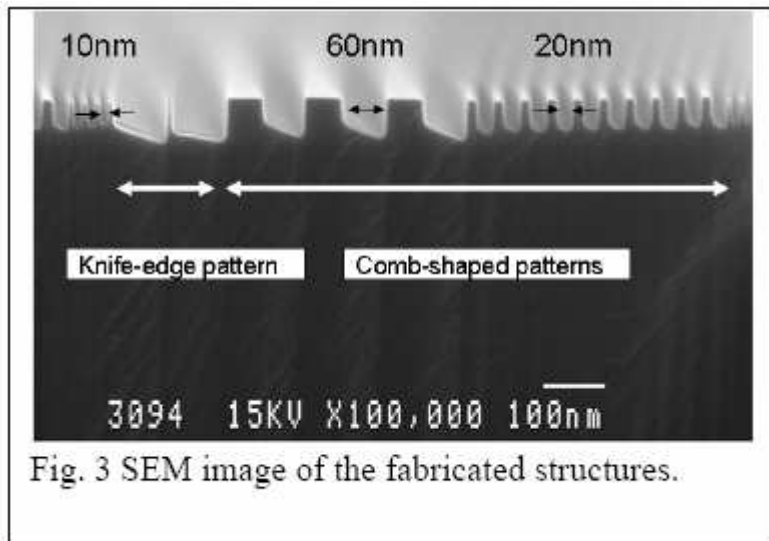
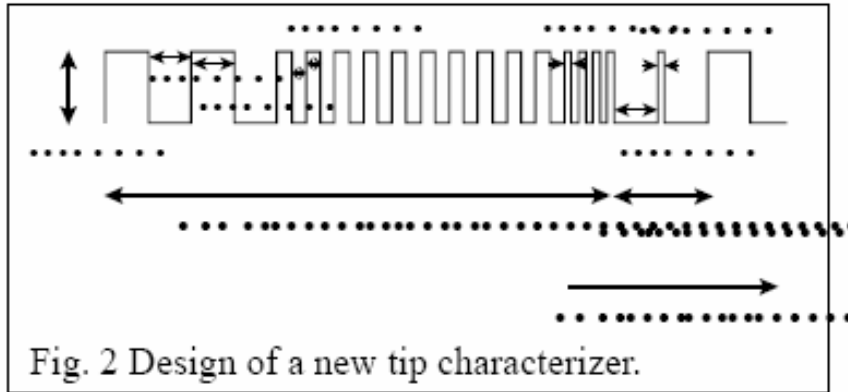
Basic Idea:

Use apparent depth of variable width trenches to characterize tip shape. (SG3 Chair sees empirical nature of method as advantageous.)



NWIP: Tip Characterization

This method does require a suitable 'comb' sample.



SG3 Chair believes method may have appeal within semiconductor industry –particularly etch depth metrology on automated systems.

Currently Planned Activities in SG3

As a result of the year two survey and year three poll of SG3 experts, the SG3 chair proposed the initiation of two new work items during year four of SG3:

(1) Overview of scan parameter artifacts in AFM imaging.

(1b) Optimization procedure for parameters – and will follow item 1a.

(2) Overview of non-topographic contrast and artifacts in AFM imaging.

Tri-National Needs Perceived by SG3 Chair

From the perspective of North American cooperation within international standards bodies, the Chair of ISO/TC201/SC9/SG3 perceives several needs:

- *Mexican/Canadian SPM Expert participation in SC9 (Note that neither Canada or Mexico is P or O member of TC201 – but this only affects voting rights. Participation of non-member experts is allowed/encouraged by ISO paradigm)*
- *Industry or user-targeted US and/or North American ‘mirror’ of SC9 – and hold satellite meetings in conjunction with relevant SPM conferences. (Chair is regular at SPIE Advanced Litho – but this may not be optimal venue. Current ASTM E42 mirror is held with AVS.) Chair hopes to explore SEMI liaison.*

Tri-National Needs Perceived by SG3 Chair

From the perspective of North American cooperation within international standards bodies, the Chair of ISO/TC201/SC9/SG3 perceives several needs:

- *Formal ISO liaison between TC213 and TC201 - US/ANSI is only P member of both – NIST has personnel deployed within TC213 and TC201 and may be well positioned to drive such cooperation. (Currently, only TC202 has TC201 liaison.)*
- *There is a general perception in some sectors that the European delegations to ISO have had more success getting their standards adopted in contexts relative to trade with the Far East. Tri-national cooperation could help bolster North American influence in this arena.*

Broader Perceptions of SG3 Chair

From a broader perspective – including North American cooperation - the Chair of ISO/TC201/SC9/SG3 observes:

- *The risk of limited relevance appears to exceed the risk of standards output detrimental to North American interests.*
 - *SC3 file format – with limited vendor participation.*
- *Some of the other national delegations to TC201/SC9 appear to place relatively low priority on broad-based engagement and buy in to committee standards activities.*
- *Optimum strategy for protection of our Tri-National interests vis-à-vis ISO/TC201 is unclear – but a broader North American interaction could be valuable.*

Recap of Possible Discussion Points for at Tri-National Workshop

- **SC9 experts from Canada and Mexico. *Further suggestions from those delegations?***
- **Tri-national SC9 mirror group & possible SPM conference linkage with satellite meetings. *What conference venues have broadest relevant tri-national participation?***
- **Formal liaisons between TC201/TC213 and/or TC229 – driven by US/ANSI/NIST?**
- **Other issues?**

Acknowledgements

Workshop Advisory & Steering Committee:

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NIST/OMP – Steve Knight, Jack Martinez, Yaw Obeng

NIST Scientific Collaborators:

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Extra Slides